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Retrospective analysis of clinical characteristics, diagnosis, treatment and complications of children with acute pancreatitis: results of a single center

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ABSTRACT

Aims: In the present study, the purpose was to evaluate the demographic and clinical data of pediatric patients, who had pancreatitis, who were followed up as outpatients or in the wards, and to evaluate the treatment modalities used along with nutritional status, length of hospital stays, and complications.

Methods: This study was carried out by retrospectively evaluating the files of 166 patients identified by INSPPIRE Criteria who were followed up at the Department of Pediatric Gastroenterology, Faculty of Medicine, at Selçuk University between 2011 and 2021. The age, gender, height, weight, known disease, drugs used, follow-up periods by us, complaints on admission, the etiological reason for the diagnosis, type of pancreatitis, length of hospital stay, treatment modalities applied, and complications of the patients were recorded. The PAPPS Scores, Ranson Admission Scores, and Ranson 48th hour Scores of the patients were analyzed.

Results: A total of 120 patients (72.3%) had AP, 25 patients (15.1%) had CP, and 21 patient (12.7%) had ARP. According to the Atlanta Criteria, 82.5% were mild and 17.5% were moderate. The most common complaint was abdominal pain and the most common cause was found to be idiopathic. There was a weak and positive correlation between the PAPPS Score, Ranson Admission Score, and length of hospital stay.

Conclusion: In the diagnosis and follow-up of pancreatitis, it is important to determine the severity of the disease and to reveal the etiology. Establishing and applying standard approaches for early diagnosis and treatment of patients will lead to prognostic improvement and prevent related complications.

Keywords: Pancreatitis, children, INSPPIRE criteria, PAPPS score, Ranson score

INTRODUCTION

Pancreatitis is an inflammation type occurring in the pancreatic tissue after the activation of enzymes because of various reasons.[1,2] The incidence of Acute Pancreatitis (AP) is 34/100000 and the incidence of Chronic Pancreatitis (CP) is 10/100000 in the general population.[3,4] Damage to pancreatic acinar cells is detected because of various reasons in the pathophysiology of AP. A local inflammatory response occurs after the release of pancreatic inflammatory cytokines with acinar cell injury. The magnitude of the inflammatory response determines the clinical severity and possible complications (e.g., pancreatic necrosis, shock, and distant organ ailure).[2,5]

The International Study Group of Pediatric Pancreatitis: In Search for a Cure (INSPPIRE) Group defined [0]Acute Pancreatitis (AP), Acute Recurrent Pancreatitis (ARP), and Chronic Pancreatitis (CP) in children in 2012.[6] Typical abdominal pain, serum AP was defined as having amylase and/or lipase levels 3-fold or higher than normal and two findings suggesting acute pancreatitis in imaging methods. ARP is defined as two or more attacks in which all findings completely return to normal between attacks. For CP, it is sufficient to have characteristic imaging findings as well as abdominal pain and endocrine/exocrine insufficiency findings consistent with pancreatitis.[6-8] Abdominal Ultrasonography (USI), Computed Tomography (CT), and Magnetic Resonance Cholangio-Pancreaticography (MRCP) among imaging methods are employed for diagnosis to show the etiology and complications.[9,10] Analgesia, pancreatic rest, intravenous fluid therapy, and monitoring for complications are essential in the treatment.

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It is still a problem to determine in advance which cases will progress with severe clinical findings or complications, and therefore, how many days of treatment will be needed in the hospital. In the present study, the purpose was to evaluate the demographic and clinical data of pediatric patients who had pancreatitis who were followed up as outpatients or in the wards and to evaluate the treatment modalities used along with nutritional status, length of hospital stays, and complications.

METHODS

The study was carried out with the permission of the Selçuk University Local Ethics Committee (Date: 24.03.2021, Decision No: 2021/164). All procedurs were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Study Group and Protocol

A total of 166 patients who had AP, ARP, and CP followed up in the Department of Pediatric Gastroenterology, Faculty of Medicine, Selçuk University, between 2011 and 2021, were included in the study. The data of the patients in the study group were reviewed retrospectively by examining the patient files and records in the Hospital Computer System.

The pancreatitis types were identified based on the criteria of INSPPIRE[6]. At least two of the following findings were considered CP; abdominal pain suggestive of pancreatitis, serum amylase and/or lipase values greater than 3-fold the upper limit of normal; at least two AP episodes and >1-month pain-free period between episodes or amylase-lipase values returning to normal values between episodes were considered ARP; exocrine and/or endocrine pancreatic insufficiency or at least one of the findings that abdominal pain suggestive of pancreatitis and radiological imaging findings consistent with CP were considered CP. The data of ARP patients during the last attack period were recorded in the study.

The age, gender, height, weight, known disease, drugs used, follow-up periods by us, complaints on admission, the etiological reason for the diagnosis, type of pancreatitis, length of hospital stay, treatment modalities applied, and complications of the patients were recorded along with previously known chronic diseases, the drugs they used, and the presence of active infection. Etiological factors were considered according to the history given at the time of admission, and laboratory and radiological findings. Patients whose cause could not be detected and who were using drugs were recorded as drug-induced pancreatitis in case of clinical and laboratory improvement following the discontinuation of the drugs. Etiological evaluation of traumatic pancreatitis was made according to the anamnesis.

Complete blood count, biochemistry values, ESR, and CRP blood test results were recorded at admission and at the 48th hour. The upper limit of amylase value was 53 U/L and 67 U/L for lipase. Abdominal USI, MRCP (if any), and abdominal CT findings were recorded from the Hospital Automation System.

The treatments applied were recorded by scanning the Epicrisis in the Hospital Automation System and the digital system. It was recorded how many days the treatment was started and how many days it was administered to the patients who were started on Total Parenteral Nutrition (TPN). It was evaluated on which day the feeding of the patients whose oral intake was discontinued was started, and on which day the diet was switched to Diet 3. It was also examined which group of patients needed surgery.

The number of days the patients needed to stay in the hospital, whether they were hospitalized in the Intensive Care Unit, whether complications developed, and on which day the complications developed and regressed were examined. The patients were grouped as mild, moderate, and severe according to the Atlanta, PAPPS, and Ranson Criteria.[11,12]

Statistical Analysis

The IBM SPSS Statistics 20 package program was used for statistical analysis. Whether the variables of the analysis showed normal distribution was examined with the Kolmogorov-Smirnov Test.The Student's t-test was used in the statistical analysis of the paired groups in independent groups to examine the relationships between the variables that had normal distribution, and the Mann-Whitney U-Test was used for the variables that did not have normal distribution.The One-Way Analysis of Variance was used in the analysis of the data with normal distribution in the analysis of more than two groups, and the Kruskal-Wallis Analysis and Shapiro-Wilk Analysis was used in the analysis of the data that did not comply with normal distribution. The categorical variables were compared by using the Chi-Square Test and the significance level was taken as $p<0.05$.

RESULTS

A total of 166 patients who were followed up with the diagnosis of Acute Pancreatitis, Acute Recurrent Pancreatitis, and Chronic Pancreatitis with history, clinical, laboratory findings, and radiological imaging results were included in the study 92 (55.4%) female and 74(44.6%) male with an F/M ratio of 1:24). The mean age of the female group was 9.92±5.29 years and the mean age of the males was 10.85±4.52.When the mean age was compared according to gender, it was not found statistically significant (p:0.223). The demographic characteristics of the patients and their distribution according to pancreatitis types are given in **Table 1**.

Table 1. The distribution of the demographic characteristics of the patients according to pancreatitis types

	Acute Pancreatitis n (%)	Chronic Pancreatitis n (%)	Recurren Pancreatitis n (%)	Total n (%)	P
Gender					0.691
Girl	67 (40.3)	15 (9)	10 (6)	92 (55.4)	
Boy	53 (31.9)	10 (6)	11 (6.6)	74 (44.6)	
Age Group					0.498
1-5 age	30 (76.9)	3 (7.7)	6 (15.4)	39 (23.5)	
6-10 age	27 (65.9)	9 (22.0)	5 (12.1)	41 (24.7)	
>11 age	63 (73.3)	13 (15.1)	10 (11.6)	86 (51.8)	
BMI					0.010
<18.5	56[a] (70.9)	13[a] (16.5)	10[a] (12.6)	79 (60.8)	
18.5-24.9	27[a] (69.3)	10[a] (25.6)	2[a] (5.1)	39 (30.0)	
>25.0	7[a] (58.3)	0[a] (0)	5[b] (41.7)	12 (9.2)	
Application complaints					
Abdominal pain	95 (57.2%)	22 (13.2%)	20 (12%)	137 (82.5)	0.095
Nausea and vomiting	89 (53.6%)	18 (10.8%)	14 (8.4%)	121 (72.9)	0.771
Lack of appetite	74 (44.5%)	16 (9.6%)	12 (7.2%)	102 (61.4)	0.521
Fever	27 (16.2%)[a]	1 (0.6%)[b]	2 (1.2%)[b]	30 (23.1)	0.021
Other	14 (8.4%)	2 (1.2%)	1 (0.6%)	17 (10.2)	0.741
Jaundice	6 (3.6%)	1 (0.6%)	1 (0.6%)	8 (4.8)	0.648
Etiology					
Idiopathic	38 (56.6)	14 (21.2)	14 (21.2)	66 (39.8)	
Infection	47 (100)	0 (0)	0 (0)	47 (28.3)	
Pancreaticobiliary	15 (68.2)	5 (22.7)	2 (9.1)	22 (13.3)	
Drugs	7 (77.8)	1 (11.1)	1 (11.1)	9 (5.4)	
Trauma	8 (100)	0 (0)	0 (0)	8 (4.8)	
Systemic diseases	4 (57.1)	2 (28.6)	1 (14.3)	7 (4.2)	
Genetic	0 (0)	3 (50.0)	3 (50.0)	6 (3.6)	
Metabolic causes	1 (100)	0 (0)	0 (0)	1 (0.6)	
Total	120 (72.3)	25 (15.1)	21 (12.6)	166 (100)	

There is no difference between values with the same letter

According to the diagnostic criteria, 120 patients (72.3%) were considered AP, 25 patients (15.1%) CP, and 21 patients (12.7%) ARP. It was found that patients who had ARP relapsed at the earliest 1 month, at the latest 36 months later.

The most common complaint was abdominal pain in 137 (82.5%) cases at admission.When the admission complaints were evaluated according to the pancreatitis types, it was found that fever was more common in patients who had AP when compared to other pancreatitis types at a statistically significant level (p<0.021) (Table 1). When the location of the pain was evaluated, it was found that the epigastric region and around the navel were the first areas of pain, and when the relationship with food was examined, it was determined that most of them were not associated with food.

When the etiologies were examined, the most common cause was found to be idiopathic at a rate of 39.7% (n:66) (Table 1).When those who had infection etiology were examined according to subgroups, 16 (9.7%) had acute gastroenteritis, 16 (9.7%) had upper respiratory tract infection, and 3 (1.8%) had lower respiratory tract infection. Gallstones were detected in 9 (5.4%) of pancreaticobiliary pancreatitis, biliary sludge in 4 (2.4%), pancreatic divisium in 3 (1.8%), choledochal stones in 3 (1.8%), common bile duct cysts were seen in 2 (1.2%), and a duodenal diverticulum in 1 (0.6%). When those who had systemic diseases in the etiology were examined, 4 (2.4%) had cystic fibrosis and 3 (1.8%) had Inflammatory Bowel Disease. When the etiology of drug use was evaluated, 3 (1.8%) non-steroidal anti-inflammatory, 2 (1.2%) oral contraceptives, 1 (0.6%) antiepileptic, 1 (0.6%) SSRI, 1 (0.6%) used antipsychotics (Risperidone), and 1 (0.6%) used 5-aminosalicylic acid (meselazine). When those with genetic disease etiology were analyzed according to subgroups, 2 (1.2%) had PRSS-1 gene mutations, 2 (1.2%) had CFTR gene mutations, and 1 (0.6%) had PRSS-1 and CFTR gene mutations.

The mean age at diagnosis of the patients according to pancreatitis types was also analyzed. The age was not statistically significant at diagnosis when compared according to pancreatitis types (p:0.868). The anthropometric characteristics of the patients and the distribution of hematological and biochemical parameters according to pancreatitis types are given in Table 2.

Table 2. The anthropometric characteristics of the patients, the distribution of the hematological and biochemical parameters according to pancreatitis types

	Acute Pancreatitis		Chronic Pancreatitis		Recurrent Pancreatitis		p
	Mean±SD	Median (Min-max)	Mean±SD	Median (Min-max)	Mean±SD	Median (Min-max)	
Age n (years)	10.24±5.18	11 (1-17)	11±3.96	11 (3-17)	10.19±4.94	10 (3-17)	0.868
BW persentile	28.5±31.81	15.5 (1-99)	31.71±27.8	26.5 (1-88)	47.11±38.19	30 (1-99)	0.154
Lenght persentile	31.41±30.62	18.5 (1-99)	35.76±26.6	31 (1-86)	41.06±34.53	34 (1-99)	0.517
BMI (kg/m^2)	17.93±4.42	17.04 (11-33.79)	17.88±2.63	17.85 (13.78-22.21)	20.01±6.96	16.93 (12.9-31.96)	0.488
WBC (10^3/ul)	10.36±5.11	9.4 (1.8-29.8)	9.87±4.16	8.6 (5.1-20.7)	10.58±4.8	10.4 (2.9-19.6)	0.780
Hemoglobin (g/dl)	12.58±2.15	12.85 (6.1-16.7)	12.74±1.95	12.8 (8.4-17.2)	13.35±1.72	13.4 (10.1-16.7)	0.930
Platelet (mm^3)	308.2±124.07	308 (30-835)	334.12±120.76	335 (88-625)	331.95±95.61	314.5 (166-524)	0.199
Neutrophil (10^3/L)	6.95±4.72	5.9 (1.1-23.1)	221.54±1074.27	5.4 (2.7-5378)	6.96±4.39	5.9 (0.9-17.4)	0.752
CRP (mg/dl)	15±33.08[a]	3.65 (0.1-205)	8.34±21.39[b]	1.4 (0.1-98)	3.17±4.04[c]	1.55 (0.1-14)	0.017
Sedim (mm/h)	15.97±15.02	12.5 (2-56)	14.18±13.8	10.5 (2-53)	9.6±5.45	10 (2-20)	0.743
Calcium (mg/dl)	9.48±0.71	9.5 (6.3-11.1)	9.72±0.61	9.7 (8.7-10.8)	9.88±0.59	9.9 (8.4-10.9)	0.133
Phosphorus (mg/dl)	4.26±0.92	4.3 (1.1-6.4)	4.7±1.02	4.6 (3-7.5)	4.48±0.86	4.5 (2.3-5.8)	0.071
Urea (mg/dl)	26.89±23.92	21 (5-170)	25.75±8.78	24 (14-44)	22.74±5.83	22 (13-37)	0.156
Creatinin (mg/dl)	0.58±0.54	0.51 (0.11-4.3)	0.49±0.17	0.47 (0.24-0.92)	0.49±0.19	0.44 (0.23-0.93)	0.675
LDH (U/L)	394.29±804.82[a]	253 (100-6524)	225.15±48.59[b]	234.5 (144-329)	261.24±55.54[b]	242 (185-361)	0.021
T. bilirubin (mg/dl)	0.85±1.19	0.56 (0.09-9.7)	1.3±3.7	0.44 (0.16-17.8)	0.68±0.65	0.43 (0.2-2.88)	0.269
D. bilirubin(mg/dl)	0.3±0.51	0.14 (0.01-3.7)	0.56±2.09	0.1 (0.05-9.9)	0.29±0.44	0.12 (0.06-1.92)	0.061
Albumin (g/dl)	4.12±0.55	4.2 (2.7-5.2)	4.26±0.46	4.4 (2.9-5)	4.33±0.54	4.4 (3.1-5.4)	0.521
Triglyceride (mmol/L)	130.5±173.29	89 (32-1368)	83.86±45.43	68 (30-216)	101.47±46.21	93 (40-201)	0.080
Glucose (mg/dl)	105.6±83.49	91 (24-798)	101.13±15.43	98.5 (78-137)	152.67±250.43	91.5 (65-1154)	0.067
ALT (IU/L)	63.15±169.45	17 (3-1530)	29.64±41.05	15 (7-171)	26.48±34.69	16 (7-153)	0.440
AST (IU/L)	112.42±466.69	30 (10-4881)	39.8±45.23	23 (16-227)	36.86±32.04	27 (14-143)	0.655
GGT (U/L)	54.9±140.34	15 (3-1243)	18.76±17.18	14 (4-87)	56.74±125.68	13.5 (8-529)	0.177
ALP (IU/L)	186.38±112.21	152 (43-665)	231.12±147.4	231 (35-686)	189.06±121.3	141.5 (75-444)	0.309
Amylase (U/L)	597.59±1166.17	234 (20-10110)	551.84±662	227 (63-2551)	808.48±710.29	346 (152-2249)	0.099
Lipase (U/L)	1241.37±4288.07	327.5 (4-45552)	916.76±1231.27	318 (11-4415)	1691.24±2001.65	446 (30-6709)	0.357

BW: Body Weight ; BMI; Body Mass Index; SDS: Standart Deviation Score; WBC: White Blood Cell; CRP: C Reactive Protein; Sedim: Sedimentation; LDH: Lactat Dehyrogenase, ALT: Alanin aminotransferase ; AST: Aspartat Aminotransferase,; GGT: Gama Glutamil Transferase; ALP: Alcalen Phosphatase. There is no difference between values with the same letter

When the radiological imaging results were evaluated, it was found that 155 (93.37%) of the patients were evaluated with USI and 102 of them were evaluated as normal (61.44%). Abdominal USI, CT, and MRI findings are given in **Table 3**.The comparison of the complete blood count and biochemical values of the patients at admission to the hospital and at the 48 th hour is given in **Table 4**.

The hospital stays of the patients ranged from 1 to 50 days (mean 10.5±8.47).The distribution of the length of stay in the wards and Intensive Care Units of the patients is given in **Table 5**.

When the treatment methods used were evaluated, 159 (95.78%) received saline intravenous fluid, 146 (87.95%) proton pump inhibitor, 65 (39.15%) TPN, 59 (%35,54) octreotide, 55 (33.13%) antibiotics, and 30 (18.07%) analgesics and 6 of the patients (3.61%) required surgical intervention. The distribution of the treatment modalities of the patients according to pancreatitis types is given in **Table 6**. Although the mean hospital stay was 6.77 days in patients who did not use octreotide, it was 17.27 days in patients who used octreotide.A statistically significant difference was detected in the comparisons (p<0.001). It was found that 14 (53.54%) of the patients who developed complications were given octreotide treatment.The most commonly used antibiotic was Meropenem (n:23; 42.6%). Other antibiotics used for pancreatitis were Cefotaxime, Teicoplanin, Piperacilin-Tazobactam, Metronidazole, Ceftriaxone, Sulfaxide, and Cefepime.

When complications were evaluated, peripancreatic fluid was detected in 15 (57.7%), pancreatic edema was detected in 5 (19.3%), pseudocyst in 3 (11.5%), and pancreatic necrosis in 3 (11.5%).When the development of complications was evaluated according to pancreatitis types, 18 (69.2%) were diagnosed with AP, 5 (19.2%) with CP, and 3 (11.6%) with ARP at a statistically insignificant level (p: 0.808). When the length of stay between the groups with and without complications was evaluated, it was 9.78 days in the group without complications and 14.38 days in the group that developed complications. When compared statistically, a significant difference was detected in this respect (p: 0.010). The duration of hospitalization in the Intensive Care Unit was found to be 2.0 days in the group without complications, and it was 2.50 days in the group that developed complications. There were no significant differences in this respect (p: 0.591). The time to start enteral feeding was 3.65 days in the group without complications and 5.00 days in the group with complications, and there were no statistically significant differences (p 0.151).

Table 3. The Abdominal Ultrasonography, Computed Tomography, and Magnetic Resonance Imaging findings of the patients

	N	%
USI Findings		
Normal	102	61.44
Biliary Sludge	13	7.83
Increase in pancreatic size	11	6.62
Gallstone	11	6.62
Peripancreatic fluid	10	6.02
Pancreas could not be evaluated	9	5.42
Pancreatic edema	7	4.21
Increased pancreatic echogenicity	6	3.61
Lymphadenopathy	5	3.01
Choledochal duct width	5	3.01
Pancreas cyst	3	1.8
Pancreatic duct dilatation	2	1.2
Choledochal cyst	1	0.6
CT Findings		
Normal	15	9.03
Increase in pancreatic size	8	4.81
Peripancreatic fluid	6	3.61
Pancreatic edema	3	1.8
Gallstone	2	1.2
Pancreatic duct dilatation	2	1.2
Pancreatic necrosis	2	1.2
Pancreatic density changes	1	0.6
Lymphadenopathy	1	0.6
Bile duct dilatation	1	0.6
MR Findings		
Normal	63	37.95
Increase in pancreatic size	18	10.84
Peripancreatic fluid	13	7.83
Pancreatic duct dilatation	12	7.22
Bile duct dilatation	10	6.02
Pancreatic echogenicity changes	9	5.42
Gallstone	8	4.81
Pancreatic pseudocyst	3	1.8
Choledochal cyst	2	1.2
Pancreatic necrosis	2	1.2
Pancreatic atrophy	2	1.2
Pancreas divisium	2	1.2

Table 5. The distribution of ward and intensive care unit hospitalization times of the patients who participated in the study

Hospitalization Duration	**Mean±SD**	**Median (Min-max)**	**p**
Gender			0.751
Girl	10.41±8.48	8.00 (1-50)	
Boy	10.72±8.37	8.00 (1-42)	
Total	10.56±8.47	8.00 (1-50)	
Age Group			0.336
1-5 age	9.82±7.44	8 (1-30)	
6-10 age	12.20±9.45	10 (1-50)	
>11 age	10.09±8.41	7 (1-42)	
Type of Pancreatitis			0.758
Acute Pancreatitis	10.63±8.57	8 (1-50)	
Chronic Pancreatitis	9.76±7.70	6 (2-30)	
Recurrent Pancreatitis	11.05±8.71	8 (1-31)	
Duration of Intensive Care Hospitalization	**Mean±SD**	**Median (Min-max)**	**p**
Gender			0.849
Girl	2.0±1.22	2 (1-3)	
Boy	2.2±1.92	2 (1-5)	
Total	2.1±1.52	2 (1-5)	
Age Group			0.098
1-5 age	2.0±0.81	2 (1-3)	
6-10 age	4.00±1.41	4 (3-5)	
>11 age	1.25±1.50	1 (0-3)	
Type of Pancreatitis			0.526
Acute Pancreatitis	1.71±1.25	2 (1-3)	
Chronic Pancreatitis	3.0±1.0	3 (1-3)	
Recurrent Pancreatitis	3±2.83	3 (1-5)	

Table 4. The comparison of the complete blood counts and biochemical values of the patients with the values at admission to the hospital and at the 48th hour

	At the time of admission to hospital		**After 48 hours**		
	Mean±SD	**Median (Min-max)**	**Mean±SD**	**Median (Min-max)**	**p**
WBC (10^3/ul)	10.31±4.91	9.25 (1.8-29.8)	7.81±3.58	6.85 (1.75-20)	0.001
Hemoglobin (g/dl)	12.7±2.08	12.9 (6.1-17.2)	12.09±2.01	12.5 (6.7-17.3)	0.001
Platelet (mm^3)	315.09±120.31	313 (30-835)	299.03±113.88	279 (40-867)	0.004
Neutrophil (10^3/L)	39.66±419.44	5.85 (0.9-5378)	4.98±4.39	4.1 (0.5-40.9)	0.293
Calcium (mg/dl)	9.56±0.69	9.6 (6.3-11.1)	9.31±0.64	9.4 (7.2-11)	0.001
Phosphorus (mg/dl)	4.36±0.94	4.3 (1.1-7.5)	4.26±0.97	4.35 (1-7.4)	0.209
Urea (mg/dl)	26.18±20.63	22 (5-170)	21.56±17.44	18 (2-149)	0.001
Creatinin (mg/dl)	0.55±0.47	0.48 (0.11-4.3)	0.77±2.98	0.46 (0.04-37)	0.366
LDH (U/L)	352.47±688.72	249 (100-6524)	325.1±522.53	234.5 (105-4530)	0.085
Total Bil (mg/dl)	0.9±1.77	0.52 (0.09-17.8)	0.91±1.64	0.59 (0.1-17)	0.285
Direkt Bil (mg/dl)	0.34±0.93	0.13 (0.01-9.9)	0.31±0.89	0.13 (0.03-9.2)	0.073
Albümin (g/dl)	4.17±0.54	4.3 (2.7-5.4)	3.83±0.49	3.8 (2.6-4.9)	0.001
ALT (IU/L)	53.41±145.95	16 (3-1530)	59.57±247.07	14 (3-2817)	0.652
AST (IU/L)	91.8±397.8	27 (10-4881)	87.13±501.26	24 (8-6111)	0.510
GGT (U/L)	49.45±127.31	15 (3-1243)	53.31±112.86	15 (1-825)	0.846
ALP (IU/L)	193.91±119.81	153 (35-686)	176.65±119.82	143 (38-918)	0.016
Amylase (U/L)	617.38±1054.18	239.5 (20-10110)	211.64±191.11	151 (13-971)	0.001
Lipase (U/L)	1249.39±3742.88	334.5 (4-45552)	263.14±292.23	178 (4-1484)	0.001

WBC: White Blood Cell; CRP: C Reactive Protein; LDH: Lactat Dehyrogenase, ALT: Alanin aminotransferase ; AST: Aspartat Aminotransferase,; GGT: Gama Glutamil Transferase; ALP: Alcalen Phosphatase.

Table 6. The distribution of the treatments applied to the patients according to pancreatitis types

		Acute Pancreatitis[a]	Chronic Pancreatitis[b]	Recurrent Pancreatitis[b]	Total	p
		n (%)	n (%)	n (%)	n (%)	
Hydration	+ -	5 (71.4) 115 (72.3)	0 (0) 25 (15.7)	2 (28.6) 19 (12.0)	7 (4.2) 159 (95.8)	0.277
TPN	- +	72 (71.3) 48 (73.8)	19 (18.8) 6 (9.2)	10 (9.9) 11 (19.9)	101 (60.8) 65 (39.2)	0.134
PPI	- +	13 (65.0) 107 73.3	5 (25.0) 20 (13.7)	2 (10.0) 19 (13.0)	20 (12.0) 146 (88.0)	0.410
Octreotide	- +	80 (74.8) 40 (67.8)	19 (17.8) 6 (10.2)	8 (7.4) 13 (22.0)	107 (64.5) 59 (35.5)	0.018
Antibiotics	- +	76 (68.4) 44 (80.0)	20 (18.0) 5 (9.1)	15 (13.6) 6 (10.9)	111 (66.9) 55 (33.1)	0.244
Analgesic	- +	98 (73.7) 20 (66.6)	19 (14.3) 5 (16.7)	16 (12.0) 5 (16.7)	133 (81.6) 30 818.4)	0.716
Surgical intervention	Not required Required	116 (72.5) 4 (66.6)	24 (15.0) 1 (16.7)	20 (12.5) 1 (16.7)	160 (96.4) 6 (3.6)	0.736
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	p
Time to start feeding (days)		3.92±3.27	3.67±2.03	4.17±2.6	3.92±3.02	0.592
Time to start normal feeding (Day) (Regime 3)		7.02±5.28	6.41±3.81	7.89±4.85	7.06±5.03	0.510
Time to start TPN (Day)		2.85±3.05	2.0±1.73	2.36±1.8	2.70±2.77	0.663
Duration of TPN (Day)		6.88±5.38	6.6±2.61	7.82±5.9	7.02±5.26	0.759
The day the amylase value starts to decrease		2.73± 2.07	2.0.5± 1.55	2.39±0.69	2.65±1.84	0.914
The day the lipase value starts to decrease		3.39±0.69	2.8 ±1.7	2.82±1.46	3.08±2.45	0.989
Day of normalization of lipase value		16.05±21.2	10.86±15.02	17.81 ±19.14	13.68±30.17	0.257
Day of normalization of amylase value		11.60±15.2	9.47±12.98	31.33±77.78	15.71±20.42	0.236

TPN: Total Parenteral Nutrition; PPI: Proton Pump Inhıbıtor. There is no difference between values with the same letter

When the patients were evaluated according to the Atlanta Criteria, 137 (82.5%) were mild and 29 (17.5%) were moderate.There was no patient in the severe disease group. When the duration of hospitalization was evaluated according to the Atlanta Criteria, it was found to be 9.77 days in the mild group and 13.93 days in the middle group, and a statistically significant difference was detected when compared statistically (p: 0.016). The PAPPS Scores, Ranson Admission Scores, and Ranson 48 th hour Scores of the patients were analyzed. The PAPPS Score was Mean±SD was 0.6±0.92. The Ranson Admission Score was Mean±SD 0.31±0.63, and the Ranson Score at the 48 th hour was 0.17±0.39.The Ranson Score of the patients decreased at a significant level (p: 0.012). There was a weak and positive correlation between the PAPPS Score, Ranson Admission Score, and length of hospital stay (p:0.001, r:0.365, p:0.007, r: 0.210, respectively). No relationship was detected in terms of length of hospital stay in Ranson 48th hour scoring.

No deaths occurred because of AP, and there was no progression to chronic pancreatitis and endocrine pancreatic insufficiency in any of the patients.The patients who were included in the study were followed up in the Pediatric Gastroenterology Clinic for an average of 12.76±18.45 months (1.0-99.0). Recurrence was detected in 21 (12.65%) patients and 10 (47.61%) of these patients had acute pancreatitis attacks twice, 7 (33.33%) 3 times, 2 (9.52%) 4 times, 2 (9.52%) 5 times.

DISCUSSION

In recent years, the incidence of pancreatic diseases during childhood has been increasing because of the increasing awareness of physicians.[13] Recovery is observed in the majority of patients without complications and recurrent pancreatitis attacks are seen in 15-35% of patients and CP may develop.[14,15]

AP can be seen in all age groups.In a study conducted by Nydegger et al. with 279 pediatric patients, the mean age was found to be 10 years at presentation and the number of male patients was 1.4 -fold higher than that of female patients.[4] In a meta-analysis that was published in 2016, the mean age was found to be 9.2±2.4 years and it was reported that female patients were more common.[16] Similarly, in the present study, the mean age was found to be 10.34±4.97 years. The rate of female patients to male patients was 1:24.

A total of 50% of the patients were diagnosed with AP, 21% with ARP, and 29% with CP in a 12-year study conducted by Poddar et al.[7] Similarly, in the present study, the majority of patients had AP and 72.3% of them were identified as AP, 15.1% as CP and 12.7% as ARP. The fact that the diagnosis age of patients with CP was higher than those with ARP and AP, and patients with CP were more than those with ARP, were associated with the chronicity of ARP and AP over time.

Regarding pancreatitis, abdominal pain, and vomiting are the leading findings that suggest the disease.In the study conducted by Werlin et al.[15] abdominal pain was detected in 45 (80%) patients, and it was reported that it was most common in the epigastric region, followed by the right upper quadrant and the right lower quadrant. Vomiting was reported in 96 (53%) patients in the same study.[15] Similarly, the most common complaint of patients was abdominal pain in 137 (82.5%) patients in the present study.Other complaints were nausea-vomiting in 121 (72.89%) and anorexia in 102 patients (61.44%). In the present study, among the patients who had abdominal pain, the pain was in the epigastric region in 57 (34.3%) patients, around the navel in 47 (28.3%), on the back in 22 16.05%)patients, both in the epigastric and umbilical region in 14 (10.21%) patients, and in the right lower quadrant in 6 (4.37%) cases. In the study that was conducted by Park et al.[17] it was reported that older children presented with complaints of abdominal pain and nausea-vomiting more than younger children, and the frequency of nausea/vomiting was 93.4% and 78.1%, respectively. Similarly, it was observed in the present study that abdominal pain was more common in older children and fever was more common in younger children. The reason for this was considered that the younger age group could not describe abdominal pain and infections were more common in the etiology. When evaluated according to pancreatitis type, it was found that fever was statistically higher than other pancreatitis types in the complaints of patients with AP. The reason for this is that infection is frequently seen in the etiology of AP.

Although the cause of pancreatitis is often gallstones and alcohol in the adult age group, systemic diseases, gallbladder disease, drugs, infection, and idiopathy in the pediatric age group. Genetic mutations and metabolic diseases were detected less frequently in the etiology.[18] In the study that was conducted by Park et al.[17] the most common cause was reported as biliary diseases (32.6%), drugs (32.6%), and idiopathic (20%).The most common causes were idiopathic (52%), traumas (21%), and pancreaticobiliary causes (10%) in Poddar's study.[7] In the present study, 66 (39.7%) of the patients who were diagnosed with pancreatitis had idiopathic causes, and infection was found to be the cause in 47 (28.3%). Although there have been developments in the diagnosis and examination in the field of healthcare in recent years, the etiology of many cases of pancreatitis cannot be clarified yet.

Many infectious agents can cause pancreatitis.[21] When the subgroups of the patients who had infectious etiology were examined in the present study, 16 (9.7%) had gastroenteritis, 16 (9.7%) had URTI, 3 (3.0%) had LRTI, 12 (7.2%) had other causes of infection.There are few data on the development of AP as a complication of Coronavirus Disease-19 (COVID-19) infection.[20] One of the patients who were included in the present study had abdominal pain complaints during COVID-19 and the patient was evaluated as FP according to INSPREE Criteria.

When pancreaticobiliary causes were evaluated, gallstones, biliary sludge, choledochal cysts, choledochal stones, and pancreatic divisium were frequently detected.[17] In the study that was conducted by Ma et al.[21] gallstones were detected at a rate of 55%, biliary sludge at 21%, and structural anomalies at 24% among biliary causes. Similarly, in the present study, pancreaticobiliary etiology was detected at a rate of 13.2%, and when those with biliary origin were examined, gallstones were found in 40%, biliary sludge in 18.1%, and structural anomalies in 16.6%.

One of the common causes of pancreatitis is drugs. Many drugs have been accused in this respect.[22] In the present study, drugs were evaluated as the cause in 9 (5.4%) patients, NSAIDs in 3 (1.8%), oral contraceptives in 2 (0.12%), valproic acid in 1 (0.6%), SSRIs in 1 (0.6%), antipsychotic medication (risperidone) in 1 (0.6%), and 5-aminosalicylic acid (mesalazine) in 1 patient.

Traumas (e.g., blunt traumas, abuse, post-ERCP, post-pancreaticobiliary surgery) were evaluated as a cause of AP with a frequency of 8-60% in the literature.[15] In the present study, 8 (4.8%) patients were found to be traumatized in etiology (blunt traumas in 4, after the replacement of the gastrostomy tube in 1 because of the insertion of the probe in front of the papilla in the duodenum, after electric shock in 1 patient, after gastrostomy tube opening and Nissen Fundoplication Surgery in 2). Traumas were less common in the etiology in the present study compared to the literature data, and it was considered that this was because trauma patients applied to the adult emergency and pediatric surgery department of our hospital.

Imaging is the first choice used in the diagnosis of pancreatitis because USI is a non-invasive and reliable diagnostic tool.[23-25] In the study that was conducted by Werlin et al.[15] USI imaging was performed in 50% of the patients who had suspected pancreatitis, and it was evaluated as normal in 75%. In the present study, 155 (93.37%) of the patients were screened with USI in the first step because it was reliable and did not contain radiation. Although 102 (61.44%) of our patients were evaluated as normal, 13 (7.83%) had bile sludge, 11 (6.62%) had increased pancreatic size, 11 (6.62%) had gallstones, and 10 (6.02%) had peripancreatic fluid.

Abdominal CT is more valuable than ultrasound in the diagnosis and for the determination of complications. Its use in pediatric patients is avoided because it contains radiation.[5] In a study that was conducted with pediatric pancreatitis patients, 73% of the patients underwent CT imaging, and pancreatic edema was detected in 38%, gallstones, biliary sludge, and cholecystitis in 17%, and necrosed pancreas in 6%.[26] In the present study, 34 of the patients (20.48%) underwent CT imaging, 15 (9.03%) were normal, and increased pancreatic size was detected most frequently in eight (4.81%) patients. In the present study, pancreatic parenchyma was normal in USI in 1 of the patients who had pancreatic necrosis, the pancreatic parenchyma was slightly heterogeneous and there was peripancreatic fluid in the other, and necrosis was observed in the CT scans performed on the same day. In 3 patients whose USI was normal, peripancreatic fluid, pancreatic duct dilatation, and gallstones were detected on CT imaging. Even if the USI is normal, further imaging must be performed in patients who are considered to develop complications.

MRI shows pancreatic inflammation earlier than other imaging methods and is often employed in etiology research rather than diagnosis.[27] MRI was performed in 107 (64.45%) of our patients, and on all patients who were diagnosed with CP and ARP. It was normal in 63 of our patients (37.95%), increased pancreatic size was most common in 18 (10.84%) patients, followed by peripancreatic fluid in 13 (7.83%) patients.Among the 11 patients who had normal findings USI, peripancreatic fluid was detected in 5, pancreatic enlargement in 4, and pancreatic duct dilatation in 2 in MRI. These results show the superiority of MRI and CT over USI in etiology and complication research.

Although the etiology is investigated in the first step in patients who are diagnosed with pancreatitis, oral intake must be stopped to rest the pancreas, and fluid replacement therapy should be started to prevent complications.[11] In the study that was conducted by Appak et al.[28] oral intake was discontinued in all patients at admission and opened within an average of four days.Similar to our study results, oral intake was opened in an average of three days. The mean time of switching to Diet 3 was determined as 7.06±5.03 days and oral intake was initially discontinued in 159 (95.78%) patients, and saline intravenous fluid containing sodium concentration appropriate for their age was administered.In a study conducted in our country, TPN was started in 32.2% of the patients for an average of 15.1±12.6 days.[30] A total of 65 (39.2%) of our patients received TPN whose onset time was 2.70±2.77 days and duration was 7.02±5.26 days. When TPN onset and duration of time were compared according to pancreatitis types, no significant differences were detected.

It was reported in the clinical report published by the NASPGHAN Pancreatitis Committee that the average hospitalization duration of pediatric patients who had pancreatitis was mostly between 2.8-8 days, and most of the patients were infants and children younger than 6 years old.[29] In the present study, the median hospital stay of the patients was 8 days, and the mean hospitalization duration was 10.5±8.47 days. When the duration of hospitalization was analyzed according to age groups, it was found that the maximum duration of hospitalization was 12.15±9.52 days in children who were aged 6-10 years.A total of 8 (4.8%) patients who were included in the study were followed up in the Intensive Care Unit and the mean hospital stay was 2.10±1.5 days. Two patients were admitted to the Intensive Care Unit for 2 days after a choledochal-enterostomy because of a choledochal cyst, and one patient was hospitalized because of severe malnutrition. Two patients developed sepsis and 3 patients developed AP because of systemic diseases during their follow-ups in the intensive care unit.

In the study conducted by Sweeny et al.[30] it was reported that 70% of ARP patients recurred in the first five months. In the present study, it was found that the patients relapsed in an average of 11.50±10.70 months, which was associated with the disruption of intermittent check-ups although the families were informed in this respect.

In their study conducted with 110 patients who had complications, Poddar et al.[7] found peripancreatic fluid in 41% and pseudocyst in 54%. Peripancreatic fluid was detected in 15 (57.7%) patients who developed complications in our study, pancreatic edema was detected in 5 (19.3%), pseudocyst in 3 (11.5%), and pancreatic necrosis was detected in 3 (11.5%) patients.

According to the Atlanta Scoring Criteria, the average hospital stay was reported to be 9.77 days in the mild group and 13.93 days in the moderate group. Although the mean Ranson Score was 0.31±0.63 at admission, the mean Ranson Score was calculated as 0.17±0.39 at 48 hours. The Ranson Scores of the patients decreased significantly (p=0.012). A weak and positive correlation was detected in the PAPPS Scores and Ranson Admission Scores of the patients.

The limitations of the present study were that it had a retrospective design and included the results of a single center. Further multicenter prospective studies are needed to develop scoring systems to determine disease severity and prognosis.

CONCLUSION

In the diagnosis and follow-up of acute pancreatitis, it is important to determine the severity of the disease and to uncover its etiology. Accurate and effective use of clinical and laboratory findings and radiological examination results of patients who apply to healthcare institutions with the preliminary diagnosis of acute pancreatitis, which still has no specific treatment and can be fatal, is essential for rapid diagnosis. Establishing and applying standard approaches for early diagnosis and treatment of patients will lead to prognostic improvement and prevent related complications.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of the Selçuk University Local Ethics Committee (Date: 24.03.2021, Decision No: 2021/164).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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